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|---|-------------|----------------------|---------------------------|------------------|
| APPLICATION NO.   | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO.       | CONFIRMATION NO. |
| 10/574,933  | 04/07/2006  | Tatsuo Nakayama      | 0403730381                | 5552             |
| 22428 7590 03/13/2007<br>FOLEY AND LARDNER LLP<br>SUITE 500<br>3000 K STREET NW<br>WASHINGTON, DC 20007 |             |                      | EXAMINER<br>QUACH, TUAN N |                  |
|   |             |                      | ART UNIT                  | PAPER NUMBER     |
|   |             |                      | 2826                      |                  |
| SHORTENED STATUTORY PERIOD OF RESPONSE  |             | MAIL DATE            | DELIVERY MODE             |                  |
| 3 MONTHS  |             | 03/13/2007           | PAPER                     |                  |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

**Office Action Summary**

Application No.

10/574,933

Applicant(s)

NAKAYAMA ET AL.

Examiner

Tuan Quach

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
  - If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
  - Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-8, 10, 11 and 13-17 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-8, 10, 11 and 13-17 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 07 April 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**


- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
- Paper No(s)/Mail Date 4/7/06.

- 4) ☐ Interview Summary (PTO-413)
- Paper No(s)/Mail Date. \_\_\_\_.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_.

  
Tuan Quach  
Primary Examiner

### DETAILED ACTION

Claims 1-8, 10, 11, and 13-17 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 1, line 2, "the semiconductor film" lacks antecedent basis and further is erroneously recited, "a semiconductor film" is not recited until line 6; "a first metal material formed the first metal is . . . " is erroneous. The language further is awkward or improper and/or confusing. Applicant is required to review the claims and rewrite it in proper English.

In claims 1 last line, claims 2, 4, line 2, "equal to" should be employed.

Claim 2 fails to further claim the invention in that it essentially repeats the same limitation in claim 1 lines 17-18.

Claim 7 erroneously depends from claim 5 as claim 7 recites the third metal layer which first is recited in claim 6 and not claim 5.

In claim 16, "forming a second metal film" is non-sequitur and unclear as to where this film is to be formed. Claim 17 fails to further defines the invention as it primarily recites the similar limitation in claim 16, last two lines.

Claims 1-8, 10, 11, 13, 15, 16, 17 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over JP 2000-164928.

Note that this corresponds to reference A20 on PTO 1449 and that a machine translation is made as only the abstract was furnished by applicant. Regarding claims

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16 and 17, these claims are anticipated by or otherwise obvious over '928 as it teaches, Fig. 1, forming on semiconductor layer 4 first metal 14 e.g. of Hf, second metal 15 of Al, [0030], treating the layers with heat at temperature of 800° C, [0050], which is at least 40°C or more greater than the melting point of Al, e.g., 660 ° or less. It would follow that eutectic alloy thereof would result and alloy starting to be formed as claimed in claim 16 last two lines would follow as well, absent evidence to the contrary and given the same layers and heat treating is performed. Alternatively, it would have been obvious to one skilled in the art that such alloy would result since the temperature is sufficiently high for such to take place.

Regarding claims 1-8, 10, 11, 13, 15, '928 teaches electrode comprising at least first metal 15 comprising Al on semiconductor 4, second metal 16 sequentially on the semiconductor film, intermediate metal 14 between between the layer 14 and the semiconductor layer, including the heat treatment as delineated above, thus would result in the alloy being formed of the first metal material Al and second metal material, e.g., Hf, and intermediate material being Hf, having melting point higher than that of Al. It would follow that eutectic alloy thereof, e.g., of first metal material and second material, would result and alloy starting to be formed (lines 17-18) as claimed would follow as well, absent evidence to the contrary and given the same heat treatment at 800° (thus at least 40° C above the melting point of Al, which is about 660° C). Alternatively, it would have been obvious to one skilled in the art that such alloy would result since the temperature is sufficiently high for such to take place.

Re claim 2, the alloy being formed is discussed above.

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Re claim 3, the temperature at 800° is shown in '928 above. The selection of suitable temperature at 800° or greater thus would have been further obvious to one skilled in the art. This corresponds to product-by-process limitations as delineated below.

Re claim 4, while the Office is not equipped to measure the melting point of the eutectic alloy in question, such would follow given similar materials and processing being employed, absent evidence to the contrary.

Re claim 5, the second metal being selected from Hf is taught above. The selection of suitable refractory metals including those enumerated would have been obvious to one skilled in the art as those corresponds to notoriously conventional refractory metals. See additionally *infra*.

Re claims 6 and 7, the third metal being interposed and comprising alloy of the first metal and second metal corresponds to alloy being during heat treatment as delineated above.

Re claim 8, the semiconductor being III nitride semiconductor is also taught, e.g., GaN.

Re claims 10 and 11, part or whole of the first metal comprising alloy including the metal material being intermediate metal layer is taught above including refractory metal, e.g., Hf above. The enumeration of various metals in claim 11 corresponds to well known alternative refractory metals and its enumeration would have been obvious to one skilled in the art. See additionally *infra* re claim 11.

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Re claim 13, a third metal having higher melting point than that of Al is further taught, e.g., Au layer 17.

Re claim 15, the semiconductor device including the electrode is taught in '928, the abstract.

Additionally, regarding the product by process limitations, e.g., heat treatment at temperature equal to or more greater the first metal being Al (last two lines), or greater than the temperature of the heat treatment, such does not impart patentability to the product claim. "[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985)

"The Patent Office bears a lesser burden of proof in making out a case of prima facie obviousness for product-by-process claims because of their peculiar nature" than when a product is claimed in the conventional fashion. In re Fessmann, 489 F.2d 742, 744, 180 USPQ 324, 326 (CCPA 1974). Once the examiner provides a rationale tending to show that the claimed product appears to be the same or similar to that of the prior art, although produced by a different process, the burden shifts to applicant to come forward with evidence establishing an unobvious difference between the claimed product and the prior art product. In re Marosi, 710 F.2d 798, 802, 218 USPQ 289, 292 (Fed. Cir. 1983) .

"[T]he lack of physical description in a product-by-process claim makes determination of the patentability of the claim more difficult, since in spite of the fact that the claim may recite only process limitations, it is the patentability of the product claimed and not of the recited process steps which must be established. We are therefore of the opinion that when the prior art discloses a product which reasonably appears to be either identical with or only slightly different than a product claimed in a product-by-process claim, a rejection based alternatively on either section 102 or section 103 of the statute is eminently fair and acceptable. As a practical matter, the Patent Office is not equipped to manufacture products by the myriad of processes put before it and then obtain prior art products and make physical comparisons therewith." In re Brown, 459 F.2d 531, 535, 173 USPQ 685, 688 (CCPA 1972).

Claims 5, 11, and 14 rejected under 35 U.S.C. 103(a) as being unpatentable over '928 in view of Gandhi.

'928 as applied above does not enumerate all alternative refractory materials, e.g., Nb, etc.

Gandhi (VLSI Fabrication Principles John Wiley & Sons 1983, p. 437) teaches alternative refractory metals, including Nb, W, Hf, Ta, Zr, Mo, Pt, Co, Cr, etc.

It would have been obvious to one skilled in the to have employed alternative and suitable refractory metals including Nb, etc., since such corresponds to well known alternative refractory metals having suitable characteristics as evidenced by Gandhi. Official notice is further given regarding other suitable materials enumerated in the claims and not enumerated above.

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The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Sotani et al. 7,078,733 B2 and Onda 5,770,489 are made of record.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to examiner Tuan Quach whose telephone number is 571-272-1717. The examiner can normally be reached on M-F from 8:30 AM to 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor Sue Purvis can be reached on 571-272-1236. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

  
Tuan Quach  
Primary Examiner